

THE STANDARD

Defining Design Problems

Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.



ETS1.A • Defining and Delimiting Engineering Problems

The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.

Engineering doesn't start with building. It starts with defining the problem precisely. Criteria are what success looks like, written so you can measure it. Constraints are the limits the solution has to live inside. Sloppy criteria and constraints lead to sloppy designs. **Tight ones make the work testable.**



Asking Questions and Defining Problems

Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

Students aren't picking a project and running. They're rewriting a vague problem into a specific one. They name what the solution must do, what it can't do, and what limits the materials, time, safety, or environment put on it. **The problem statement is the deliverable.**



Influence of Science, Engineering, and Technology on Society and the Natural World

All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.

Every design choice ripples outward. A new product uses resources, affects people, and changes the natural environment. Students consider those impacts up front, not after the prototype is built. **The constraints on a real design include "what does this do to the people and the planet around it?"**